# JAWS: Justified AWS-like data through workflow enhancements that ease access and add scientific value

Completed Technology Project (2017 - 2019)

Project Introduction

Automated Weather Station and AWS-like networks are the primary source of surface-level meteorological data in remote polar regions. These networks have developed organically and independently, and deliver data to researchers in idiosyncratic ASCII formats that hinder automated processing and intercomparison among networks. Moreover, station tilt causes significant biases in polar AWS measurements of radiation and wind direction. Researchers, network operators, and data centers would benefit from AWS-like data in a common format, amenable to automated analysis, and adjusted for known biases. This project addresses these needs by developing a scientific software workflow called "Justified AWS" (JAWS) to ingest Level 2 (L2) data in the multiple formats now distributed, harmonize it into a common format, and deliver value-added Level 3 (L3) output suitable for distribution by the network operator, analysis by the researcher, and curation by the data center. Polar climate researchers currently face daunting problems including how to easily: 1. Automate analysis (subsetting, statistics, unit conversion) of AWS-like L2 ASCII data. 2. Combine or intercompare data and data quality from among unharmonized L2 datasets. 3. Adjust L2 data for biases such as AWS tilt angle and direction. JAWS addresses these common issues by harmonizing AWS L2 data into a common format, and applying accepted methods to quantify quality and estimate biases. Specifically, JAWS enables users and network operators to 1. Convert L2 data (usually ASCII tables) into a netCDF-based L3 format compliant with metadata conventions (Climate-Forecast and ACDD) that promote automated discovery and analysis. 2. Include value-added L3 features like the Retrospective, Iterative, Geometry-Based (RIGB) tilt angle and direction corrections, solar angles, and standardized quality flags. 3. Provide a scriptable API to extend the initial L2-to-L3 conversion to newer AWS-like networks and instruments. Polar AWS network experts and NSIDC DAAC personnel, each with decades of experience, will help guide and deliberate the L3 conventions implemented in Stages 2-3. The project will start on July 1, 2017 at entry Technology Readiness Level 3 and will exit on June 30, 2019 at TRL 6. JAWS is now a heterogeneous collection of scripts and methods developed and validated at UCI over the past 15 years. At exit, JAWS will comprise three modular stages written in or wrapped by Python, installable by Conda: Stage 1 ingests and translates L2 data into netCDF. Stage 2 annotates the netCDF with CF and ACDD metadata. Stage 3 derives value-added scientific and quality information. The labor-intensive tasks include turning our heterogeneous workflow into a robust, standards-compliant, extensible workflow with an API based on best practices of modern scientific information systems and services. Implementation of Stages 1-2 may be straightforward though tedious due to the menagerie of L2 formats, instruments, and assumptions. The RIGB component of Stage 3 requires ongoing assimilation of ancillary NASA data (CERES, AIRS) and use of automated data transfer protocols (DAP, THREDDS). The immediate target recipient elements are polar AWS network managers, users, and data distributors. L2 borehole data suffers from similar

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interoperability issues, as does non-polar AWS data. Hence our L3 format will be extensible to global AWS and permafrost networks. JAWS will increase in situ data accessibility and utility, and enable new derived products (both are AIST goals). The PI is a long-standing researcher, open source software developer, and educator who understands obstacles to harmonizing disparate datasets with NASA interoperability recommendations. Our team participates in relevant geoscience communities, including ESDS working groups, ESIP, AGU, and EarthCube.

Primary U.S. Work Locations and Key Partners
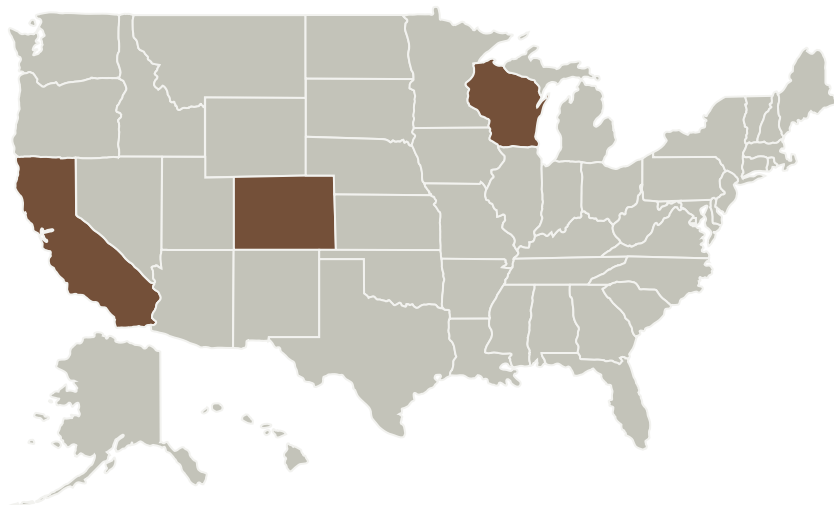
Organizations Performing Work	Role	Type	Location
University of California-Irvine	Lead Organization	Academia Asian American Native American Pacific Islander (AANAPISI), Hispanic Serving Institutions (HSI)	Irvine, California

Primary U.S. Work Locations	
California	Colorado
Wisconsin	

Organizational Responsibility

Responsible Mission Directorate:
Science Mission Directorate (SMD)

Lead Organization:
University of California-Irvine

Responsible Program:
Advanced Information Systems Technology

Project Management

Program Director:
Pamela S Millar

Program Manager:
Jacqueline J Le Moigne

Principal Investigator:
Charles Zender

Co-Investigators:
Wenshan Wang
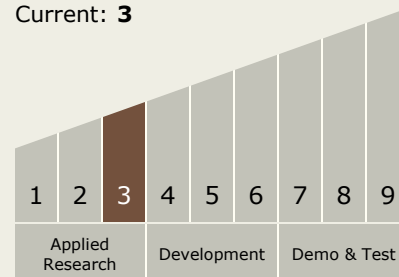Matthew A Lazzara
Siri Jodha S Khalsa
James Wang

Technology Maturity (TRL)

Start: **3**
Current: **3**

1	2	3	4	5	6	7	8	9
Applied Research			Development			Demo & Test		

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.4 Information Processing
    - TX11.4.1 Science, Engineering, and Mission Data Lifecycle

Target Destination
Earth